

# THE ANTI-GRAVITY HANDBOOK

BY

JAMES E. COX

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# THE SCOPE OF SPACE DRIVE RESEARCH

## \*\*\* AN INTRODUCTION \*\*\*

The term "space drive", derived as it is from science fiction lore, is used here to denote a broad range of unconventional propulsion systems that lie on the borderline of the technological frontier. In the realm of orthodox technology, the term covers such propulsive devices as jets, rockets and ion propulsion systems. However, it additionally covers the developing new technology of force field propulsion, based on Lorentz forces and other electromagnetic field effects. It also covers a technology that deviates from accepted physical principles; reactionless space drives such as the Dean Drive and other directional force generators of purely mechanical nature. Space drives are anti-gravity devices and teleportation systems. In brief, the term covers a broad spectrum of concepts that permit the fast and effective transport of men and merchandise within the reaches of outer space.

Almost ten years ago the Space Drive Research Society was informally organized to promote interest and research in this new field of technology.

As of this date, the list of new space drive concepts worthy of detailed investigation grows longer and longer. Over one hundred new systems are now on record in our files. Some are good ideas, others are worthless. Our policy has been to investigate all ideas, regardless of the fact that they may contradict known laws, or defy traditional patterns of thinking in the propulsion field. We believe that it is urgent that a new concept of space propulsion be developed to replace the rocket, which is conceptually obsolete.

Perhaps the morphological approach espoused by Dr. Fritz Zwicky at Cal Tech best characterizes our research philosophy. According to Zwicky, in his book Discovery, Invention, Research, "morphological analysis and...planning...have been conceived for the express purpose of properly appraising all of the facts needed for the unbiased deduction of the possible solutions to any given problem. Only after all of these solutions have been thoroughly evaluated do we select that one among them that best satisfies our requirements. I repeat, absolute detachment from all prejudice and a thorough acquaintance with all essential elements, or pegs



**FORCE FIELD PROPULSION:** (as used here) a long range resilient and intangible field capable of exerting "action at a distance" forces on other bodies in the universe.

**INERTIA NEUTRALIZATION:** The inertia (resistance to motion) of a body is canceled by gravitational isolation of that body with the rest of the universe. Only minute forces would be required to obtain tremendous accelerations.

**ANTI-GRAVITY:** The gravitational field intensity between two bodies is made zero or negative so that no attraction takes place. Electrogravitics offers control of gravity forces by electrical means.

**REACTIONLESS SPACE DRIVES:** Newton's Third Law is bypassed or made void. No reaction force is simultaneously present with the action force on a body. This might occur in certain anomalous mechanical phenomena.

**TELEPORTATION:** Transmission of matter as a pure energy form at the velocity of light or faster and the exact re-assembly of initial mass at the terminal point.

**SPACE WARPS:** By controlling the

curvature of space-time in General Relativity Theory, it may be possible to create "wormholes" that connect two or more universes together. We may thus warp ourselves from one point in space to another.

**TIME TRAVEL:** Time and space are inseparable in General Relativity. The rate of passage of time may be manipulated by the expenditure of energy. Time could be made to speed up, slow down or become negative.

In Appendix II of this book we have given a complete listing of all the space drive concepts that have been proposed to date. Over the last decade some one hundred plus space drive systems have come to our attention. No doubt there are many more, but we think this list is well representative of current and past thinking on this subject. We might also categorize these concepts according to the scientific reliability of our sources of information. In which case, many would receive a low reliability rating. Not all space drive workers are professional scientists or engineers, yet we believe the work of all individuals must be thoroughly and objectively investigated as our financial resources will allow.

Most of the mechanical space drives



done for atoms or larger particles. To transmit a human being would require a light beam of incredible energy. Yet, there are rumors that some type of teleportation has been achieved. Niven (147) gives a good discussion of some of the aspects of teleportation.

Space warps and time travel both have their basis in Einstein's Special and General Theory of Relativity. The slowing down of time (time dilation) (197) is already an experimental fact. Taking time dilation into consideration, Lawden points out (197) that it is possible to travel at infinite effective velocity. Thus, we can reach any part of the universe in a fraction of a second, for all practical purposes. Wheeler (200) has set the stage for the possibility of warp travel in his work on "wormholes" in General Relativity.

For several decades now intelligent, trained witnesses have been seeing Unidentified Flying Objects in the sky. The possibility that they are spacecraft from other worlds has not been ruled out. If we assume they are some kind of vehicle, how are they propelled? Might not a close scrutiny of their flight characteristics give us a hint as to how they are propelled? In any discussion of space drives, flying saucers cannot be ignored.

Equally important as the discovery of the ideal space drive (which most certainly will not be a perpetual motion machine) is the development of a free energy source that is lightweight yet delivers substantial power. Recently, thermonuclear fusion scientists have become optimistic that a Tokamak or laser-lithium pellet approach will solve the controlled fusion reactor problem. More interesting are the claims by numerous individuals, such as Henry Moray (143) that free energy of great practicality has been developed. Free energy, according to these investigators, can come from space itself. If this energy can be converted into a practical form, we could easily power our space drive no matter where we were in the universe.

Finally, we see evidence of what we might call natural biological space drives--individuals, such as shamans or priests, who have reportedly levitated themselves by their powers of concentration. Rhine (199) documents numerous cases where the mind can exert a mechanical influence on its environment. Could this represent some kind of mental gravity control?

Any inventor who claims to have built a space drive must be prepared



## CHAPTER II - NOVEL REACTION SPACE DRIVES

In this chapter we will discuss several techniques of propulsion that do not rely upon the familiar rocket-jet action that is in common use today. It seems that the more theoretically feasible a particular concept is, the more disadvantages we have to put up with. The concepts we will mention here very well fit this notion.

Perhaps one of the most clever ideas is the true skyhook proposed by several scientists at Scripps (8), a modern version of the tower of Babel. It was proposed that we put into synchronous orbit (about 23,000 miles up) a satellite and extend a cable from it down to the surface of the earth. The satellite would be stationary over the surface of the earth and the centrifugal force of the satellite would keep the cable taut. Using this cable, acting as a conveyor belt, objects could be elevated to a height of weightlessness using strictly ground-based power. The scientists examined the forces that would be required to keep the cable from breaking and concluded that it was possible from an engineering point of view. One difficulty they failed to note is that there is a 360,000

volt potential difference at 1800 amps between the surface of the earth and the ionosphere. It is estimated that it would take approximately ten minutes to discharge all of this current. If the Scripps scientists used a metal cable, this planet could be in deep trouble. Obviously, insulators would have to be mounted along the cable every mile or so. Whether or not these insulators could withstand the enormous tension, is a question that must be considered. Even so, the idea provides a novel solution to the problem of getting out of the earth's gravitational potential well, which is the hardest part of any space drive journey.

A concept which is more related to familiar propulsion techniques is the interstellar ramjet, originally proposed apparently by Bussard (24) and elaborated upon by Bond (16) and Mallove (137) and others. The idea is based upon the fact that interstellar space is not a perfect vacuum. There is approximately one hydrogen atom per cubic centimeter. Hence, there is at least some matter that can be used for reaction propulsion. The problem is that it is extremely rarified. Bussard proposed that a magnetic field extending hundreds of kilometers into space be used to sweep up this interstellar



leave the ground. This acceleration can be achieved by strictly electromagnetic means. Such an idea would be feasible on a planet having little or no atmosphere to impede the motion of the accelerated mass once it leaves the electromagnetic launcher. If you ejected a mass into the atmosphere of earth at escape velocity (25,000 mph) it would soon burn up.

In 1969 this author proposed a novel method of propulsion utilizing rebounding vortices (45). The idea is to quantize the normally short-range force fields used in various electromagnetic levitation schemes (15,127). I speculated that it would be possible to synthesize a particle-like entity called a vortex which, by rebounding off the surface of a planet or other reaction body, could impart momentum to the space drive. The beauty of the idea is the potential high efficiencies to be gleaned. One difficulty is that atmospheric drag could reduce the range at which rebound could take place. However, if the correct frequency of oscillation is chosen--one that is not strongly absorbed by the atmosphere--the idea could be put to good use. The concept of a particle-like force field is not without theoretical foundation. Wheeler (200) has worked out its existence and has called it a "geon". Unfortunately, in order for

the geon to be stable, gravitationally, it must be extremely enormous in size--lightyears in diameter. A little bit oversize for what I had in mind!

However, the idea of vortices is not essential to my theory. The fundamental idea is the Momentum Exchanger Principle--using small elastic masses moving at high velocity to transfer momentum to a large mass via rebound. We could use rubber balls, bouncing off a prepared surface (one that is hard and smooth) to achieve acceleration. This might have use on the moon to decelerate or launch regularly scheduled spaceships with great efficiency. These elastic masses would limit the range. On the other hand, we could use rebounding laser beams, to achieve long range momentum transfer.

The use of sound to achieve propulsion has been completely overlooked by specialists in this field. Charroux (35) mentions the work of a Professor Prudhomme, at the Institut Pasteur in Paris, who succeeded in levitating cork balls with low powered ultrasound. In America, G.E. Henry writes about his experiments in sonic levitation in an article in Scientific American dealing with ultrasonics. Henry writes about "the migration of heavy bits of material to the pressure-nodal



## CHAPTER III - FORCE FIELD PROPULSION

In this Chapter we will discuss the subject of electromagnetic space drives, which, as a whole, operate in strict accordance with the Third Law. These space drives depend upon the existence of an environmental electrical or magnetic field (or some other kind of force field) in the surrounding space to absorb the recoil of the space drive's forward acceleration. However, there are exceptions to this rule, and they will be discussed.

The electromagnetic space drives have the advantage of having no moving parts (generally) to wear out, as is the case for the mechanical space drives. Their means of operation is both simple and quiet. Only a faint electrical "humming" noise would be evident. Aside from their silent operation, efficiency should be good, since there will be no friction among moving parts. Poor electrical efficiency derived from current resistance losses can be minimized by the application of cryogenic technology in the use of superconductors. Energy losses, overall, will be in the usual form of heat and radiation. As in the case of electronic space drives, operating at high frequencies, emission of unretrievable energy in the form

of radiation is inescapable. But, if we are using free energy sources to begin with, who cares? We then have power to spare!

There are six basic conceptual approaches to building electromagnetic force field propulsion systems:

1. Using strictly electrostatic repulsion.
2. Systems employing a static magnetic field repelling the field of the magnetosphere.
3. Propulsion devices employing alternating magnetic fields in a spatial oscillating magnetic field.
4. Systems using mechanically accelerated charged bodies in a static or alternating magnetic field.
5. Space drives relying upon the Quincke Effect. (see Appendix III)
6. Systems using alternating electrical fields interacting with "neutral" massive bodies such as the earth.

Cook (42) has given an excellent detailed report on the feasibility of using electrostatic lift for space vehicles. His idea is to purposely put a net charge on a planet such as the moon and use the electric field set up to propel or decelerate a charged spacecraft. The idea sounds good for the moon, which has no atmosphere to leak away the charge, as is the case



discussed here.

The scarcity of research reports on external force field propulsion systems may be simply due to lack of interest or security classification. Conventional propulsion specialists place a high emphasis on achieving larger, and larger specific impulses (i.e., getting as much of an impulse out of each pound of propellant as possible). This usually means a higher exhaust velocity--feeding most of your total energy into an exhaust stream. Hence, they choose light elements such as hydrogen and try to accelerate small quantities of it to high velocities. This leads to designs involving internal force fields.

In external force field research, the emphasis is placed elsewhere. We don't want to waste energy by throwing it out the nozzle. Instead, we wish to react against a large volume or mass of the medium and put most or all of the total energy into the space drive itself. Appendix I gives you an idea of what we mean by the term efficiency.

Fortunately, interest in external force fields is increasing. Aside from the work of Cook, the research of Dr. Way (201) based on Rice's

patent (161) concerning an electromagnetically propelled submarine, is worth discussing. This concept is based upon the Lorentz force equation (Appendix III). Current is passed through seawater (which is a fair conductor of electricity) at right angles to a magnetic field set up by the submarine. The result is an external force field that pushes against a large volume of seawater, propelling the sub in the opposite direction. Externalization of the force field is not as good as one would like it to be, since the magnetic field decreases inversely with the cube of the distance from the field coil. Also, Dr. Way, in his working models built originally at the University of California at Santa Barbara and now at Westinghouse, is having problems with the current decomposing the seawater into hydrogen and oxygen. Aside from this, it has great potential. If superconductivity can be integrated into the idea, larger thrusts could be obtained per unit mass.

Now, can this same idea be used for atmospheric and interstellar flight? So far as this author is aware, Finch (84) is the first to mention the idea of using this concept for propulsion in a flying vehicle. He thought of it



## CHAPTER IV - REACTIONLESS SPACE DRIVE SYSTEMS

"It seemed to me that a weight whirling around a horizontal shaft, moving more rapidly above than below, could furnish lift by virtue of the greater centrifugal force at the top of the path."

-Robert H. Goddard

The above quotation is from Lehman's biography of this great rocket pioneer (131). This man later gave up on the idea of using centrifugal force for thrust in favor of liquid fueled rockets. Fortunate for us that he did, for more recent attempts to harness the forces of spinning unbalanced masses has generally met with failure. The problem is Newton's third law - for every action there is an opposite and equal reaction. However, not everyone agrees with the validity of this law. Burling, in his letter to the American Journal of Physics for May, 1969 (page 567-8), discusses the problem of the third law. Violations and exceptions are mentioned. Perhaps, therefore, an escape clause exists that will allow some ingenious inventor to build a reactionless space drive. We will discuss several attempts in this chapter.

Perhaps the most widely publicized reactionless space drive was the Dean

System Space Drive (12, 25-32, 48, 57-66, 156, 159 & 203) patented by Norman L. Dean in 1959. Figure #9 in Appendix IV shows how this system is basically constructed. Dean claimed he was able to generate an alternating unbalanced force and then, through a system of shifting solenoids, electromagnetic clutches and commutators, he was able to "rectify" this oscillating force much like we might rectify alternating current with a diode. Dean uses a pair of counter-rotating unbalanced weights driven exteriorly by a rotary engine of some type. A clutch rides the oscillator and is coupled to the load when the oscillator is moving in only one direction. During this moment centrifugal force thrusts the load forward. The backward swing of the oscillator is not used. According to Dean's engineering data, 40 pounds of thrust per horsepower are possible from this reactionless space drive. Analysis of the device by Jones (113) shows that these performance figures violate the Law of Conservation of Energy. Dean apparently bases his device on an anomalous phenomena he calls "phasing" described in the May, 1963 issue of Analog. If the phenomena he describes is valid, theory indicates his device should work. However, experiments by Cox (48) and Stine (178) failed to demonstrate the validity of "phasing".



vertical axis. When rotation about this vertical axis is initiated, the p-mass is observed to ascend the tilted rod. Pittman believes that this effect may be used for propulsion. He has done a considerable amount of theoretical analysis of the effect but has yet to build a model that will pass the pendulum test.

Bella (11) has acquired a patent on an "Apparatus for Imparting Motion to a Body" that is similar in concept to Cox's Alternating Force Rectifier via Vector Inversion and Schoonrok's Rotary Energy Conversion System. The idea is to get a mass to move in a particular three dimensional path called a "Viviani window". According to Bella, "It is found that such motion of the mass imparts motion to the body in a direction preselected by selecting the orientation of the curve relative to the body." He continues, "A vehicle being translationally moved by the apparatus of the invention may be braked by reversing the orientation of the axes and rotating mass or masses to a mirror image or by reversing the direction of the motor."

Former Professor at Michigan State University, Arthur W. Farrall has obtained a patent on an "Inertia Propulsion Device" (82). According to Product Engineering (81), Farrall has demonstrated a model about 1 ft

long and weighing 6 1/2 pounds that dragged a 1/2 pound weight up a moderate incline. (See Figure #14) The model consists of a pendulum suspended weight held against a cam by spring tension. "During the cocking stroke, a small electric motor turns a cam that pushes the weight slowly forward while a spring attached to the weight is tightened (energized). In the power stroke the cam releases the weight, which is snapped back by the spring. This pull of the swinging weight is strong enough to draw the vehicle toward it. This means the vehicle must move forward until the force of the weight is taken up by its shock absorber. Calculations indicate that a 60-lb weight accelerated to 500 ft/sec<sup>2</sup> would provide 900 lb of push."

Auweele's "Prime Mover" (7) employs a similar idea in the use of a flywheel instead of a suspended weight. According to Auweele, "A first displaceable mass supports a second mass which is driven in reciprocation thereon through a flywheel and crank and rod system, there being a spring means subjected to deformation during one direction of travel of the reciprocating mass thereby to store energy, the spring means releasing the energy during the other direction of travel thereof to impart a net thrust on the first mass to displace the same."



"Here end my trials for the present. The results are negative. They do not shake my strong feeling of the existance of a relation between gravity and electricity, though they give no proof that such a relation exists."

-Michael Faraday

In previous chapters we discussed a variety of space drives and found that, while many of them are possible, they would not provide for the unlimited acceleration of a human being. If, however, a gravitational field can be generated, a spacecraft could accelerate at tremendous rates without the occupants feeling any sensation of motion, since every atom of their body would be accelerated at the same rate. We will list several theories of gravity below and examine the electrogravitics reports.

Theories of gravity might be broken down as follows:

1. G-vector Hypothesis: The G force is the third force due to a resonating electric and magnetic field.
2. Gravity is a pushing force from without, not a pull from within.
3. Gravity is due to the force generated by dipole particles existing in the non-uniform fields of neighboring bodies.

4. Gravity is due to force arising between ordinary matter, but that anti-matter or negative energy would be repulsive.

5. Wilbur Smith's ideas that gravity is due to a skew electric vector.

6. Gravity is a distortion of space itself and can be thought of in terms of Einstein's Principle of Equivalence in General Relativity.

7. Gravity is due to a resonating magnetic field emitted by all bodies.

8. Gravity between planets can be thought of as aggregates of fundamental particles acting as spherical capacitors rotating in the fields of other bodies, generating or empowered by slightly deflected centripetal dielectric displacement currents.

Space prevents us from discussing these ideas in detail. For a serious and scientific treatment of attempts to explain gravity, see R.P. Feynman's Lectures on Gravitation (Cal Tech, Pasadena, CA.) and the works of the Gravity Research Foundation (98). The reader may also refer to the following references: 4, 19, 67, 71, 146, 168, 172-176, 181, and 200. These references generally offer more orthodox explanations of gravity, with some exceptions.



## CHAPTER VI - INERTIA NEUTRALIZERS

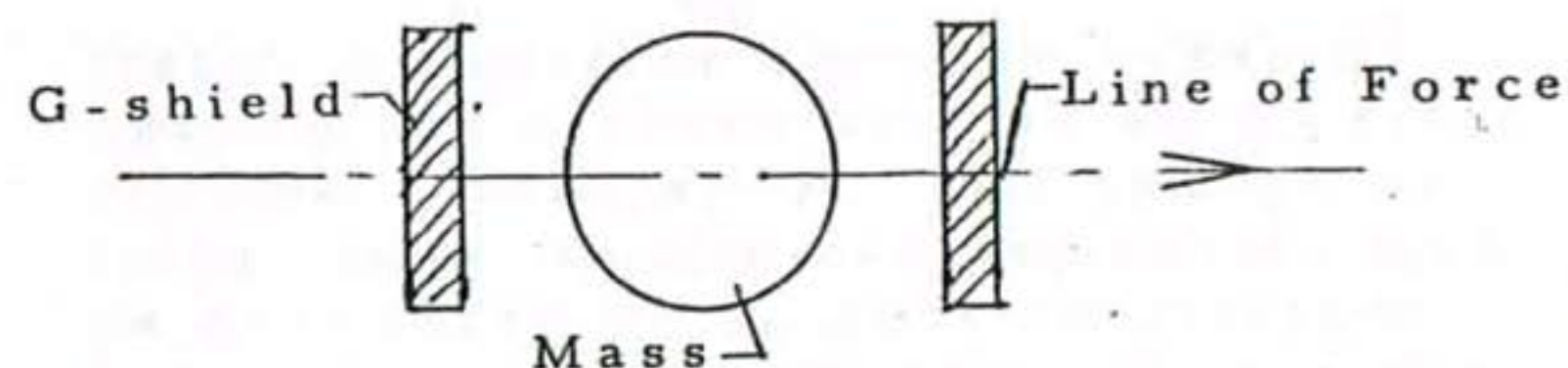
According to Newton's Second Law, the acceleration of a body of mass (M) is given by:

$$a = F/M$$

where (a) is the acceleration and (F) is the applied force. The mass (M) here is the inertial mass. Clearly, if the inertial mass is effectively reduced and the force remains unchanged, the acceleration is increased. We may reduce this mass by actually taking away some of it or we may seek to reduce its inertial resistance. In both cases, we achieve a greater acceleration.

According to Mach's Principle,\* the inertia of a body is due to the gravitational interaction of that body with the rest of the universe. If this interaction could be negated or neutralized, the body would have no inertia. Suppose it was possible to shield off the force<sup>of</sup> gravity by means of a piece of cavorite; the following situation would be possible:

\*Sciama, D. W., The Physical Foundations of General Relativity, Doubleday Anchor Book, Doubleday & Company Inc., Garden City, N. Y., 1969.



The mass would have zero inertia in the direction of the applied force and would achieve infinite acceleration when the slightest force was applied. We could use conventional rocket propulsion to achieve incredible velocities. Most importantly, the human occupants of this mass would not experience any sensation of the acceleration, since their inertial resistance is also zero. Swann (181) discusses the possibility of a gravity shield: "If gravitational forces could be explained in terms of waves, and if matter were such that these waves, when impinging upon suitable matter, set up other gravitational waves, we might be able to realize a shield for gravitation in the same way that we shielded the radio, ... against the waves from without by the metal container with which we surrounded it."

In 1964, Dr. Erwin Saxl reported the results of his research on an electrostatically charged torque pendulum. He found that the period of oscillation was related to the applied voltage. Saxl says "The physicist hesitates to form a working hypothesis for such



## CHAPTER VII - TELEPORTATION

Several years ago the author attended an Armed Forces Open House in Alameda, California. There, the Navy had a teleportation system set-up. To this day I am not sure whether or not it was a joke or represented a more serious research project. The set-up consisted of two 6-foot high pieces of apparatus. You looked into an opening near the center and saw a goldfish in a bowl. When the demonstrator turns the machine on, the goldfish and bowl disappears and reappears in the other apparatus. I asked the attendant how it operated and he replied that "It works well," sidestepping my call for a technical explanation. Admittedly, this would be easy to fake. I wasn't impressed with the reality of the fish; perhaps it was just the image from a hidden projector, a weak attempt to duplicate Disney's Haunted House visual effects. But the Navy exhibit correlated with a rumor I heard elsewhere that they were doing serious and successful research on teleporation. Supposedly, they had succeeded in teleporting a frog's leg-with only one minor problem-they could get only part of the leg reassembled! Just recently I heard a new one on a radio show--that some years back in San Francisco, some mice were teleported to New York in a mere three seconds! It would be interesting to trace these rumors to their source!

Teleportation will herein be defined as the transmission of matter at the velocity of light or faster (preferably instantaneously) over vast distances, much like we now send information via radio or TV. If we think of matter as nothing more than an aggregate of information, then one wonders (if we can send TV pictures) can we move in- to the third and higher dimension and transmit living beings? Essential technology of teleportation may be broken down into three concepts:

1. Matter is decomposed into a light beam and sent to a receiver where it is reconstructed.
2. Matter is scanned, say, through holographic techniques, and information about it is transmitted for reconstruction (replication). (see Lawden, 197)
3. Tunnel effect - matter is sent through a time warp (see discussion on warp travel in Chapter VIII).

Nivens (147) has discussed the difficulties of teleportation and has speculated upon its consequences. Let us consider the scientific and technological problem of teleportation.

The first disturbing fact is that teleportation via Method I requires enormous energy to send even the smallest amount of matter. From Einstein's equation  $E = mc^2$ , to convert matter



"This is the captain speaking. We are ready for our first Jump. We will be temporarily leaving the space-time fabric to enter the little known realm of Hyper-space, where time and distance have no meaning. It is like traveling across a narrow isthmus from one ocean to another, rather than circling a continent to accomplish the same distance."

-Isaac Asimov

The Stars Like Dust

Let us seek to abolish any false conceptions we have about the properties of the space through which the space drive moves. Is space simply a smooth, continuous nothingness, endowed with no properties of its own? Or does it possess a structure or "fabric" that may be put to good use in permitting us to traverse vast interplanetary and interstellar distances? If the work of John Wheeler at Princeton has any relation to fact, then space must be endowed with properties that transcend all our classical primitive notions!

Berry, in his article on space warps (Saga, March, 1972) writes about the work of Wheeler and its relation to "Faster Than Light Spaceships".

Wheeler and Fuller published a paper in 1962 (Physical Review 128, #2, Oct 15, p. 919-929) entitled "Causality & Multiply Connected Space-Time" deal-

ing with "wormholes", which can be considered as the theoretical basis for space warp travel. Wheeler describes a wormhole (illustrated on the following page) that "shows the geometry of space at a particular moment of time...on a particular slice of space time". This wormhole, or space warp, was proposed to provide a geometrodynamics model of electric charge. General relativity teaches that the flow of time is dependent upon the region of space-time in which it exists; that is, the surrounding environment. In other words, time is curved like space! The space-time properties of the wormhole are best understood by considering two points, A and B, located near the mouths of the wormhole. Such points could represent the location of our sun and a neighboring star. There are two routes one can take to get from A to B; the "long route" around the mouths of the wormhole as indicated by a dotted line, and where space and time have their normal meaning. Or, one can take the "short route" through the throat of the wormhole where space and time do not exist. In this region of "superspace" or "hyperspace", a lightbeam or material object can travel almost instantaneously from point A to B!

Wheeler, however, is quick to emphasize



## CHAPTER IX - TIME TRAVEL

As we normally think of them, space drives provide for travel in three-dimensional space. Yet, the properties of space are more accurately described in terms of four dimensions, including the dimension of time. Why should we be confined to travel in only three dimensions? If the definition of "space drive" is to be really complete, it must also incorporate time travel.

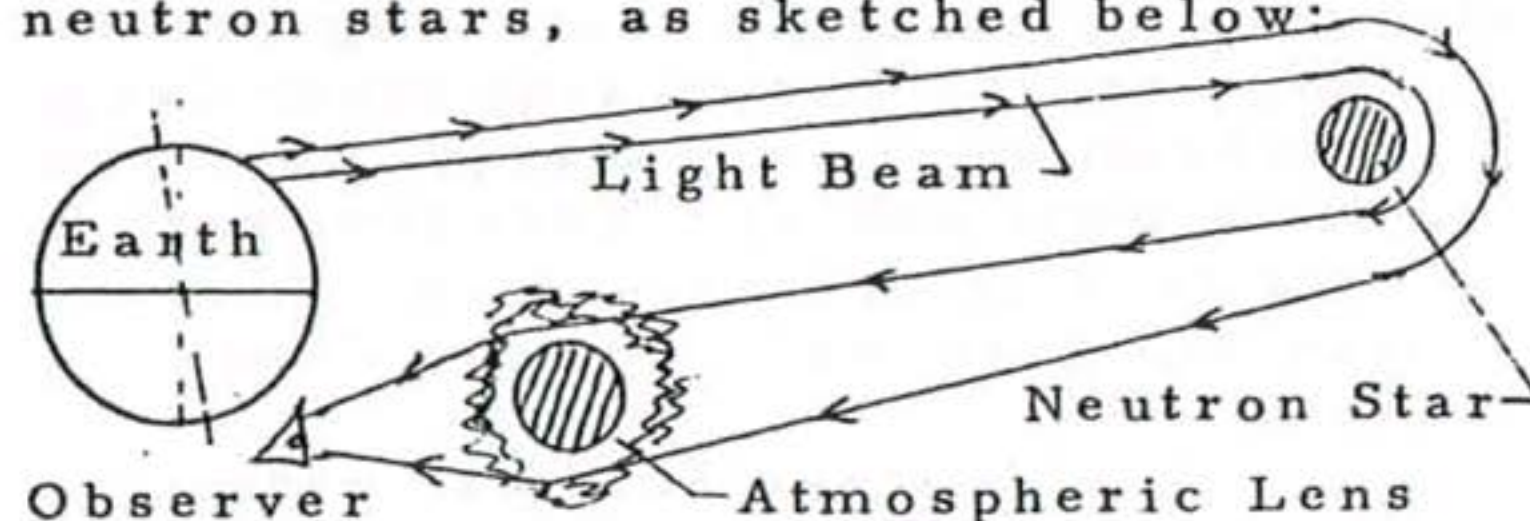
In his article on time travel, which he considers The Last Frontier (Space-flight, Sep., 1970, p. 374-377), Edwards writes of two kinds of travel in this fourth dimension:

(1.) First, we have the case where the time traveler simply "observes events and people in the past or future, without them becoming aware of being observed by a visitor from another time.

(2.) Second, the case where the time traveler "will change past or future events, either by being observed by the inhabitants of those times or by his actual physical intervention in the scheme of things".

Zwicky (see p. 184-186 of his book mentioned earlier) believes it is actually possible to see ourselves as we lived and acted in the past by observing

old earthlight reflected back by cosmic objects. He suggests that light which left the earth many years ago could be bent back to us by dense, massive neutron stars, as sketched below:



**ZWICKY'S TYPE I TIME MACHINE**  
Indeed, it is speculated that we might be able to use the atmospheres of stars or planets to act as telescopic lens to observe this weak, returning light beam. Thus, a neutron star located some 1000 light-years away could allow us to see Christ walking the surface of the earth!! Admittedly, this is not as fun as actually being physically present in the past. However, that too might be possible.

Since the days of H.G. Wells, and his prediction of the time dilation effect in his book The Time Machine (and latter confirmed theoretically by a fellow named Einstein), science has made some progress in improving the prospects for Edwards' Type II time travel. We, for example, experimentally confirmed the time dilation equa-



## CHAPTER X - UFO's: CLUES TO PROPULSION

It has not been universally established, of course, that Unidentified Flying Objects represent an alien technology superior to our own. In the final analysis, until we have captured one of these so-called UFO's, taken it into the laboratory and carefully dissected it piece by piece, will we confirm the nature of UFO's. Let's assume, however, that they do represent advanced spacecraft and follow through this hypothesis. If we can scientifically establish that such flying hardware is possible, we will have given credence to the spaceship hypothesis. If they are spacecraft, how can a propulsion system be devised to account for their observed behavior?

Several authors (102,134) have endeavored to use the various laws of physics to show the impossibility of spacecraft visiting our world from neighboring solar systems that could harbor life of advanced forms. Generally, these individuals are suffering from an acute lack of creativity. This book has already reported on numerous propulsion systems that would make interstellar flight feasible. Several of these spacecraft theories would induce effects similar to those witnessed in many UFO confrontations (99). Hall

of NICAP writes about the electromagnetic effects of UFO's. Auto ignition failure and stalling could be explained by UFO's generating a powerful oscillating magnetic force field. The Condon report (52) failed to investigate the effects of a motional magnetic field on the ignition system of automobiles. Klass (122) tries to establish that UFO's represent natural plasma phenomena. The possibility that they represent artificial plasma propulsion systems is not mentioned by Klass.

Plasma propulsion using alternating magnetic fields seems to be one good possible explanation for the flight characteristics of UFO's. Such a theory has been offered by Finch (84), Winder (189) and recently Rosa (206). The essential theory has been well studied by many individuals (38). If the magnetic force is of sufficient strength, interstellar flight using hydrogen would still be possible. Almost 99 % of the universe is in a plasma state--plasma propulsion is a logical possibility.

Flying saucer contactees have offered more esoteric theories of UFO flight. Adamski (1) says they ride on magnetic currents of space. Smith (172-176) says they have used gravity control



## CHAPTER XI - PSYCHIC LEVITATION & TELEKINESIS

"I saw him slowly rise up in a continuous gliding movement, and remain about six inches off the ground for several seconds, when he slowly descended. ...I passed my hands under his feet, round him and over his head when he was in the air. On several several occasions, Home and the chair on which he was sitting at the table rose off the ground."

-Sir William Crookes

The idea of "mind over matter", referred to as "telekinesis" or "psychokinesis" (abbreviated PK), and psychic levitation must be regarded with skepticism by the physicist. The propelling of objects or oneself by the force of thought defies conventional scientific explanation. How can a human being move an object without any tangible mechanical means? As absurd as it must seem to the newcomer, such cases have actually occurred.

In his first book, Cramp (207) devotes a chapter to the subject of psychic levitation. He refers to a book by Olivier Leroy entitled Levitations (Burns Oates, London, 1928) that documents several hundred cases of levitation. The most well known case concerns the investigations of the well-known medium Daniel Douglas Home by the eminent scientist Sir William Crookes in 1874.

Homes was reported, in one instance, to have floated out the windows of a building high above street level in London on December 13th of 1868 as witnessed by several members of the Council of the Royal Society. Home's levitation ability is not unusual; in the East, feats of human levitation are an accepted fact. The Hindus say it can be accomplished by having the correct mental attitude combined with special physical exercises involving deep rhythmical breathing. Leroy mentions numerous cases of very pious individuals, "persons full of religion and piety who, in the fervour of their orisons, have been taken up into the air and remained there for some time". This levitation by priests and nuns, was on many occasions against their own will. One nun describes her experience: "...and now and then the whole body as well, so that it was lifted up from the ground...It seemed to me, when I tried to make some resistance, as if a great force beneath my feet lifted me up."

Such phenomena is still occurring today all over the world. Cramp himself mentions a case that he witnessed in 1947. Quoting from Cramp, "Then quite suddenly and again without warning, John and his chair were lifted



## CHAPTER XII - NOVEL FREE ENERGY SOURCES

Numerous inventors have claimed to have succeeded in extracting unlimited free energy, apparently from space itself. This free energy is available without the expenditure of any work; almost as if it were something for nothing, in defiance of the Law of Conservation of Energy. This cannot be the case, however; if these free energy devices do work as claimed, they are no more in violation of any law than is a water wheel or solar cell. If sufficient energy density can be obtained from these devices, they may provide the final answer to the question of how to power a space drive at any point in space.

The great genius Nikola Tesla was one of the first inventors to pioneer the development of free energy. In his U.S. Patent #685,957 of Nov. 5, 1901 entitled "Apparatus for the Utilization of Radiant Energy", he describes the operation of his device. "My present invention is based upon a discovery which I have made that when (ultraviolet) rays or radiations ... are permitted to fall upon an insulated conducting body connected to one of the terminals of a condenser while the other terminal of the same is made by independent means to receive, or to carry away electricity, a current flows into

the condenser so long as the insulated body is exposed to the rays, and under the conditions hereinafter specified an indefinite accumulation of electrical energy in the condenser takes place. This energy after a suitable time interval, during which the rays are allowed to act, may manifest itself in a powerful discharge, which may be utilized for the operation or control of mechanical or electrical devices, or rendered useful in many other ways."

Henry Moray (143, 144) has made further significant innovations to the extent that he is able to obtain one kilowatt of power per pound of electronic apparatus of his invention. He says "It is now estimated, because of present advances in dielectrics that a 100 pound unit can be made to deliver 300 KW" of power!!! He describes how his device works: "Oscillations by synchronization are started in the first stage of the circuit of the device by exciting it with an external power source such as the difference of potential between two points. The circuit is then balanced through synchronization until the oscillations are sustained by harmonic coupling with the energies of the universe. The reinforcing action of the harmonic coupling increases the amplitude of the oscillations until the peak pulses "spill" over into the next stage through special detectors



# APPENDIX I -- MECHANICAL EFFICIENCY OF REACTION SPACE DRIVES

GENERAL: The mechanical efficiency of a reaction space drive (such as a rocket or force field drive) is defined as the kinetic energy acquired by the space drive divided by the total energy (kinetic) expended. If the mass ratio - the ratio of the reaction mass to the space drive mass at any instant - is four or greater, efficiencies of 80% or better are possible.

Consider two masses ( $M_1$ ) and ( $M_2$ ) reacting against each other in accordance with Newton's Third Law:



Mass ( $M_1$ ) acquires momentum ( $P_1$ ) and kinetic energy ( $K_1$ ), and mass ( $M_2$ ) achieves equal momentum ( $P_2$ ) and kinetic energy ( $K_2$ ). Let ( $M_1$ ) be the mass of the space drive. Then the amount of energy it obtains relative to total energy expended is defined as the mechanical efficiency:

$$e = K_1 / (K_1 + K_2) \quad (1)$$

but the kinetic energy is defined as follows:

$$K_1 = 1/2 (M_1 V_1^2) \quad (2)$$

$$K_2 = 1/2 (M_2 V_2^2)$$

hence:

$$e = M_1 V_1^2 / (M_1 V_1^2 + M_2 V_2^2)$$

But, by the Law of Conservation of Momentum:

$$P_1 = P_2 \quad (3)$$

or:

$$M_1 V_1 = M_2 V_2$$

or again:

$$M_2 / M_1 = V_1 / V_2 \quad (4)$$

We now define equation (4) as the MASS RATIO ( $M_r$ ), which is simply the reaction mass  $M_2$  divided by the space drive mass  $M_1$ :

$$M_r = M_2 / M_1 \quad (5)$$

Now, taking equation for (e) above and dividing the numerator and the denominator by  $M_1 V_1^2$  we immediately obtain:

$$e = 1 / (1 + (M_2 V_2^2 / M_1 V_1^2))$$

Finally, substituting in ( $M_r$ ) for  $M_2 / M_1$  and  $1/M_r$  for  $V_2 / V_1$  we obtain:



## APPENDIX II -- Space Drive Listing

In the following listing, we have categorized space drives according to the following classification system:

- A. Mechanical Space Drives
- B. Electromagnetic Space Drives
- C. Miscellaneous Drives

In each case, we give the name of the inventor, to the best of our knowledge, and the date of conception. More information on the space drive can be obtained from the bibliography or from the author of this book.

### A. MECHANICAL SPACE DRIVES

1. Coanda Effect Lifting Devices (Coanda, 1939)
2. Entropy Engine (Jones, 1967)
3. Magnus Effect Lifting Devices (see Swanson, 1961)
4. Non-simultaneity Surge Drive (Davis, 1962)
5. Skyhook Via Satellite Elongation (Isaacs, Vine, Bradner & Bachus, 1966)
6. Kinetic Diode (Jones, 1969)
7. Momentum Exchanger Principle (Cox, 1969)

### A. MECHANICAL SPACE DRIVES

8. Propulsion System (Trupp, 1965)
9. Project Orion (see Dyson, 1968)
10. Interplanetary Cables or Roads (Unkn.)
11. Giant Sling Shot or Magnetic Accelerator (See Clarke)
12. Very High Tower (Tower of Babel)
13. Cannon (Verne, 1800's)
14. Flapping Wing
15. Aerial Screw (da Vinci; 1600)
16. Full-Wave Alternating Force Rectifier By Vector Inversion (Cox, 1967)
17. Radial Force Generator (Keeney, 1970)
18. Directional Force From Rotary Motion (Nowlin, 1944)
19. Centrifugal Variable Thrust Mechanism (Laskowitz, 1934)
20. Propulsion Mechanism (Quisling, 1930)
21. Direct Push Unit (Llamorzas 1953)
22. Momentor (Ecklin, 1966)
23. Gamma Drive (Pittman, 1961)
24. Dean System Space Drive (Dean, 1959)
25. Gyrothrust (Kellogg, 1967)
26. Flywheel Drive (Cox, 1967)



## B. ELECTROMAGNETIC SPACE DRIVES

22. Magnetic Induction Drives (Spinning and Vibrating Coils)(Cox, 1967)
23. Superconductive High Current Drive (Cox, 1967)
24. Electromagnetic Vortex Rebounder Drive (Cox, 1968)
25. Space Propulsion by Magnetic Field Interaction (Engelberger, 1964)
26. Magnetic Sink Drive (Smith, 1950)
27. Rotating Field Electrostatic Apparatus (Davis, 1968)
28. Laser Propulsion (Redding, Marx, Forward, Norem, 1960)
29. An Alfven Propulsion Engine (Drell, Foley, Ruderman, 1965)
30. Levity Disc Project Ezekial (Searl, 1968)
31. Interstellar Ramjet (Busard, 1960)
32. Circular Foil OTC-X1 (Carr, 1950)
33. Vortella Project (Japolsky, 1964)
34. Rotating Magnetic-Antigravity Device (Schoonrok, 1968)
35. Laser Rebounder (Cox, 1970)
36. Gravitational Machines (Dyson, 1962)

37. Radiation Drive (Kraspedon, 1960)
38. Electric Force Field Ramjet (Cox, 1972)
39. Alternating Electrostatic Repulsor (Cox, 1972)

## C. MISCELLANEOUS SPACE DRIVES

1. Gravitational Machines (Dyson, 1962)
2. Protational Field Drive (Forward, 1961)
3. Nuclear Fusion Rockets
4. Rockets Using Matter-anti matter Annihilation
5. Force Field Propulsion (Kaplan, 1960 and Murtaugh, 1965)
6. UFO Propulsion Theories of MIND (1966) and Cramp (1966).
7. G-Vector Space Drive Hypothesis (Fry, 1961)
8. Etheric Vortex Drive (Roos, 1970)
9. Verne's Cavorite (Verne, 1800)
10. Gravity Shield (Nipher, 1920)
11. Tachyon Propulsion (See Feinberg, 1970)
12. Naval Philadelphia Experiments on Force Fields (Allende, 1953)
13. Space Warp Drives (Henderson, 1971)
14. Hyperwarps
15. Teleportation (Niven, Jones, 1966)
16. Time Travel (Verne, & others)



force exerted on a body moving over a surface or rubbing against another body. The force is equal to the coefficient of friction of the body and the normal force holding the two bodies together.

GRAVITY FORCE: The gravitational force between two masses is equal to the product of the masses divided by their separation distances squared.

HEISENBERG FORCE: An exchange force between nucleons in which charge (equivalent to spin plus position) is exchanged.

LENZ'S LAW: If an electromotive force is induced in a circuit due to a change in the flux of magnetic induction through the circuit, the sign of the electromotive force is such that any current flow is in the direction that would oppose the flux change. This is how a repulsion coil operates.

LORENTZ FORCE EQUATION: The force exerted on a charge moving in an electric and magnetic field is equal to:  $F = Eq + qv \times B$ , where  $E$  is the electric field,  $q$  the charge,  $v$  the velocity and  $B$  the magnetic field.

MAGNETIC FORCE: The force between two magnets is equal to the product of their magnetic fields divided by the separation distance squared.

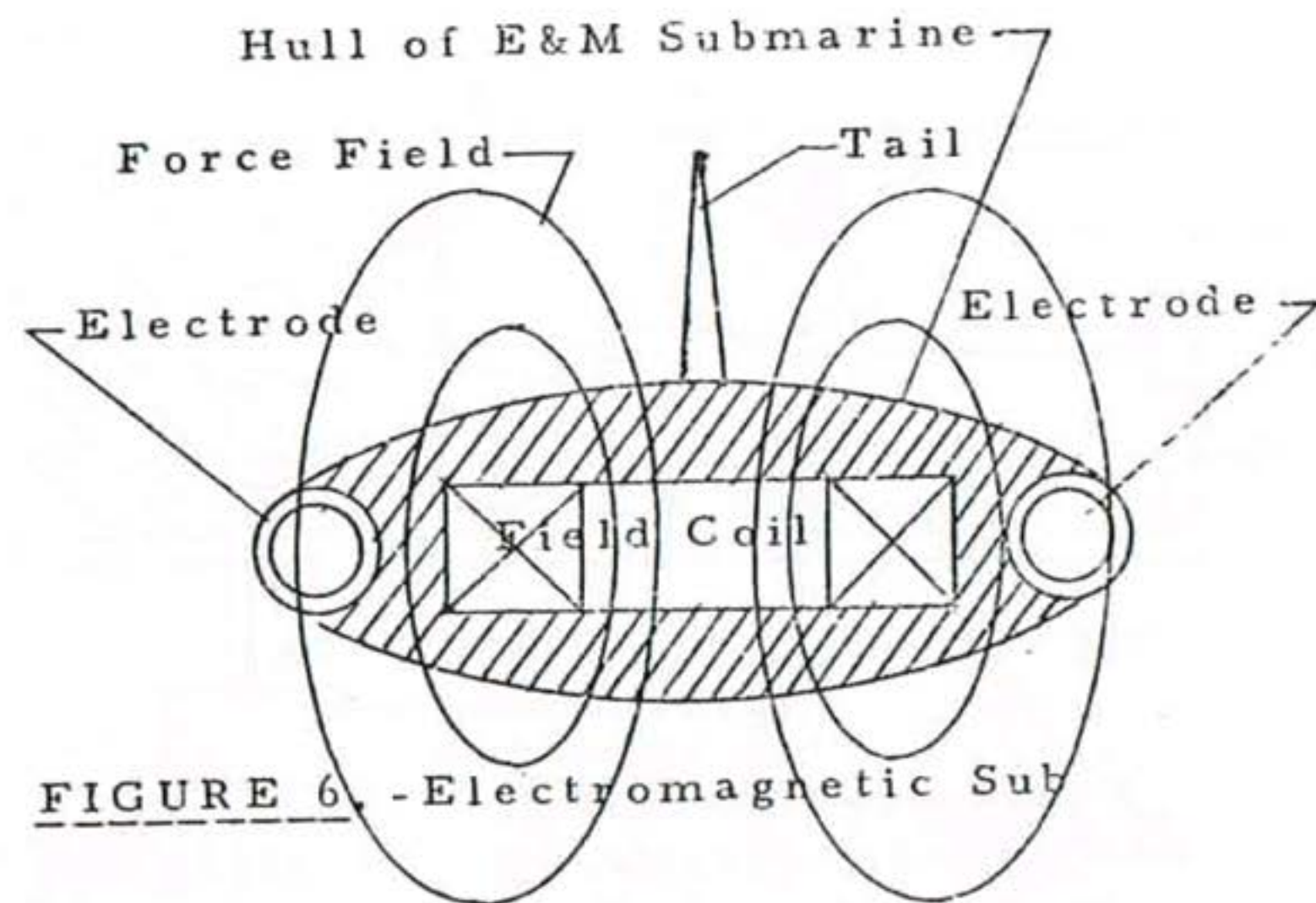
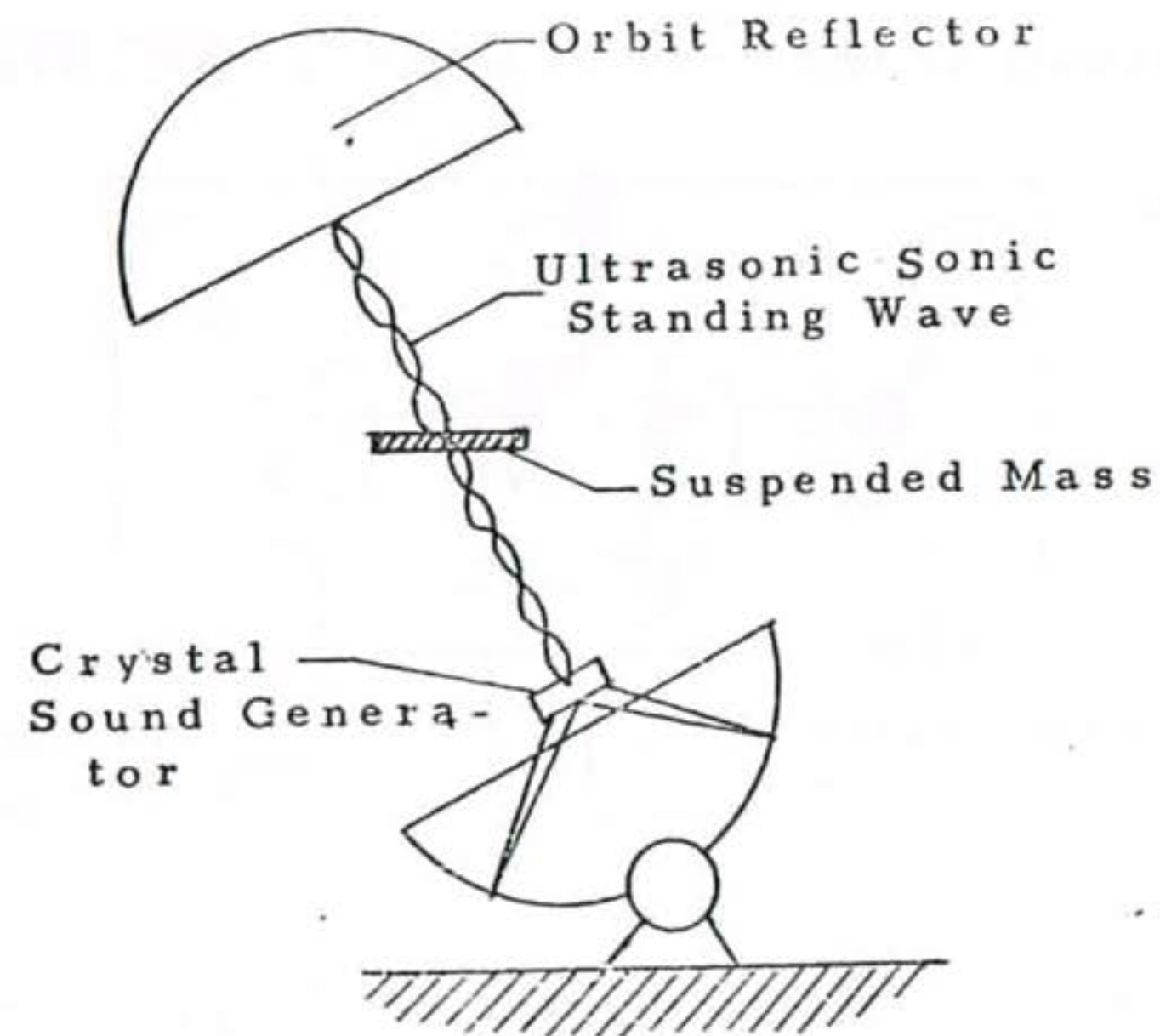
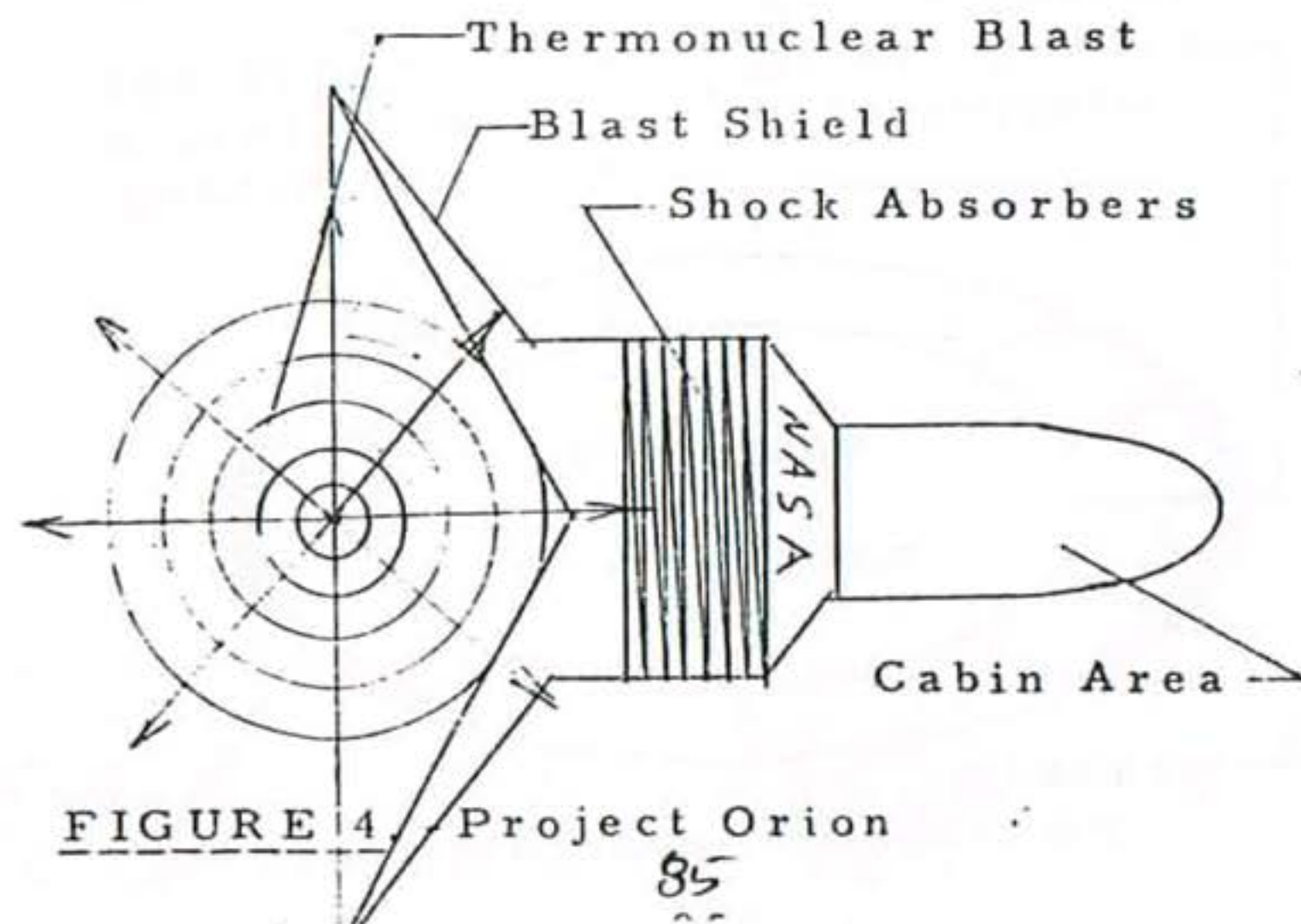
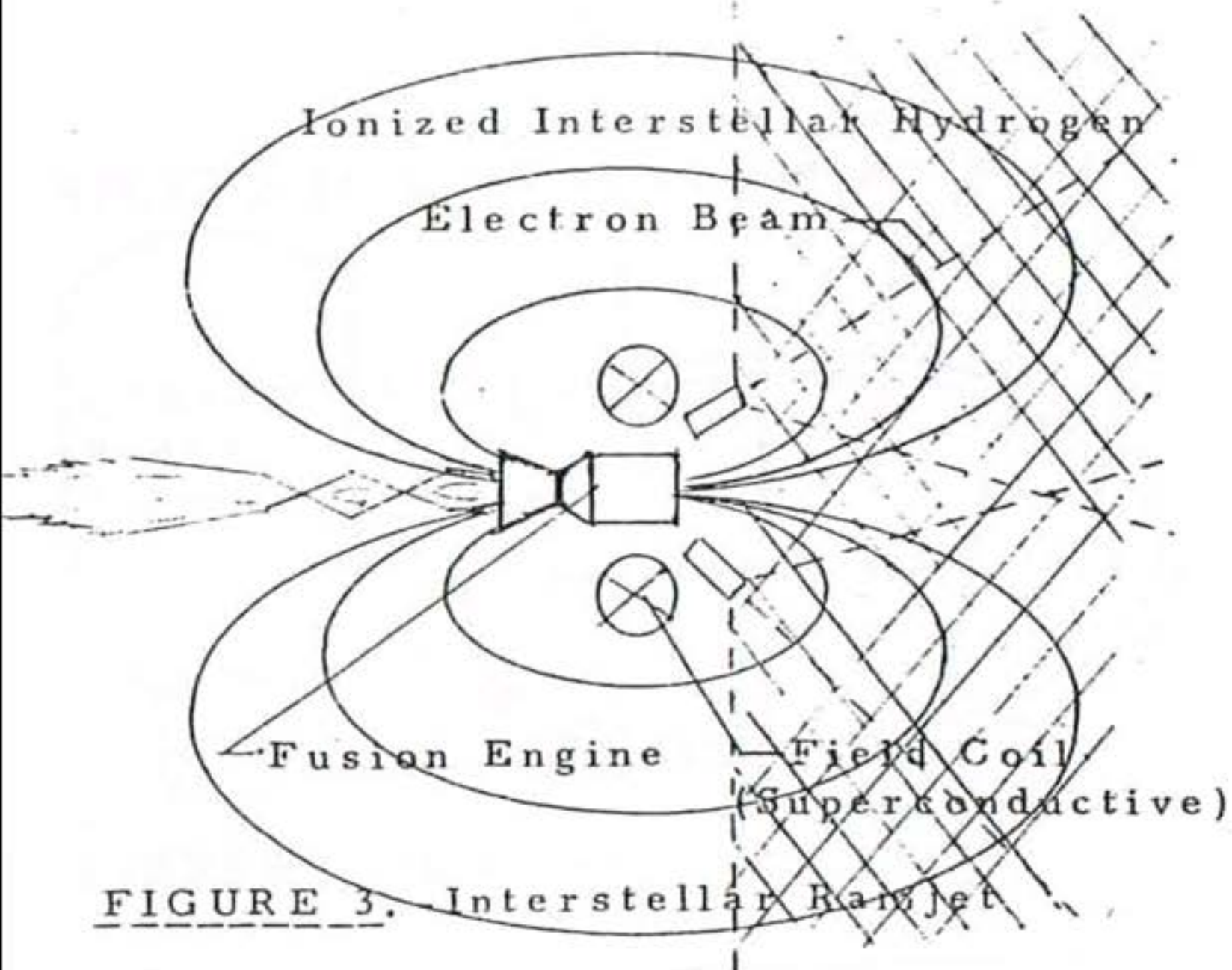
MAGNUS EFFECT: When a rapidly spinning body is hung up in an air current moving at right angles to its axis, it is deflected at right angles to both the current and its axis and moves to the side where its peripheral motion is in the same direction as the current.

MAJORANA FORCE: An exchange force between nucleons in which charge and spin are exchanged (equivalent to exchange of position). If the nucleons are represented by wave-functions, then if the wave functions are symmetric with respect to interchange of the space coordinate, the Majorana force is attractive; if the wave-functions are antisymmetric, the Majorana force is repulsive.

QUINCKE EFFECT: A substance of high magnetic susceptibility tends to move into the strong region of a magnetic field. Similarly, a substance of high dielectric constant tends to move into a strong electric field.

RADIATION PRESSURE: The force exerted by light on a surface. If the surface is reflecting, the momentum imparted to it is twice the energy of the light beam divided by its velocity.







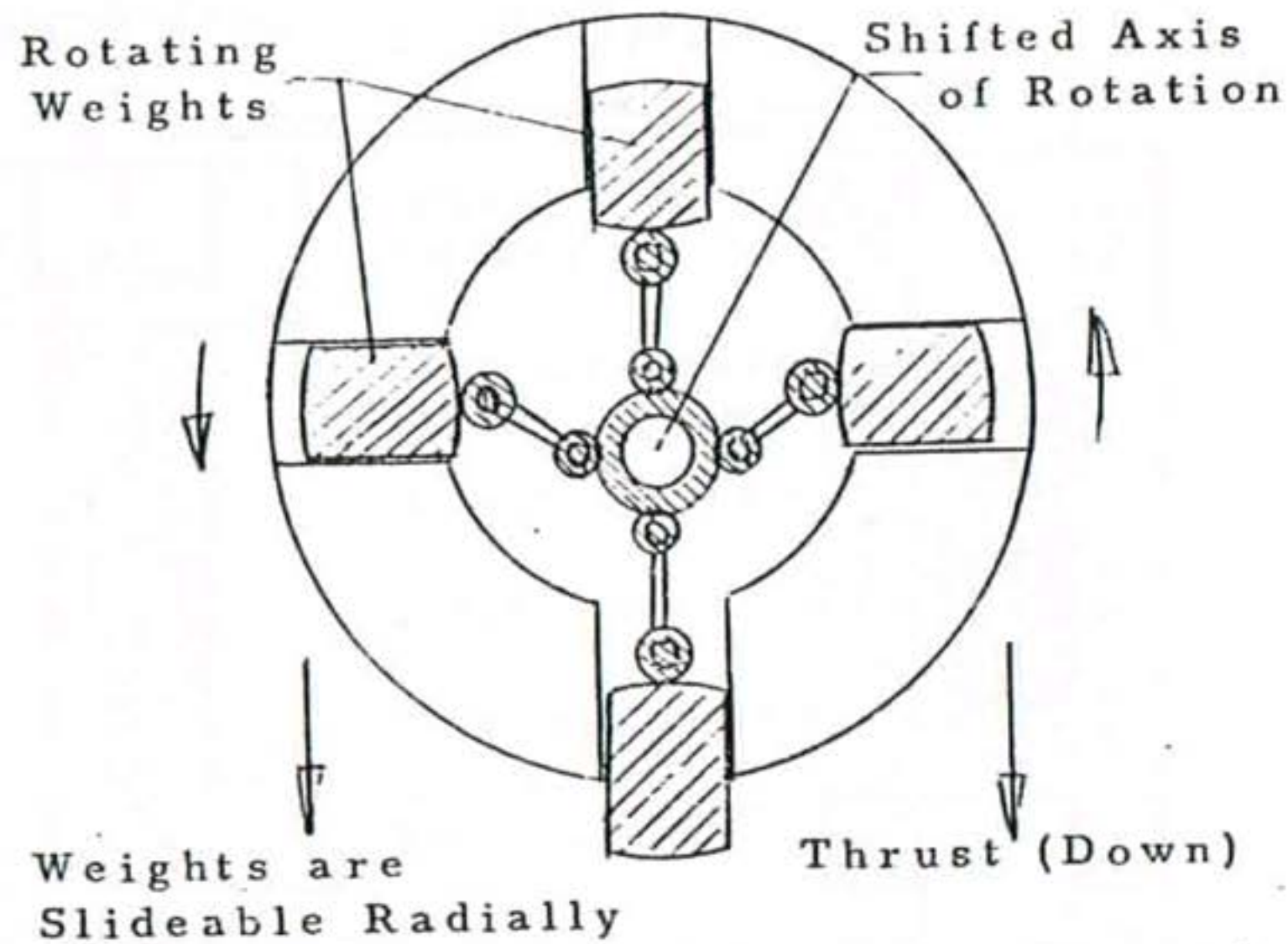


FIGURE 11. - Centrifugal Thrust Device

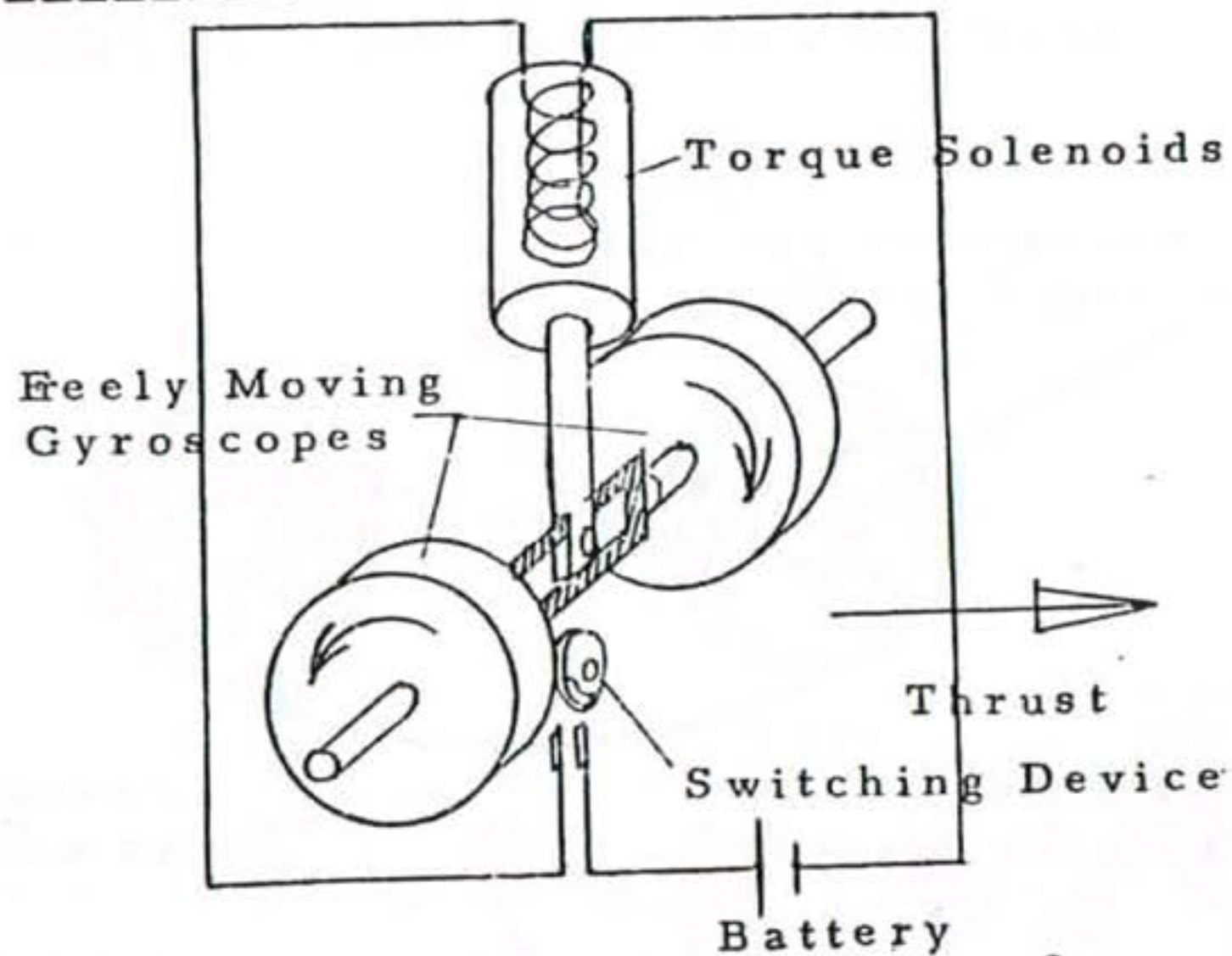


FIGURE 12. - Gyrothrust

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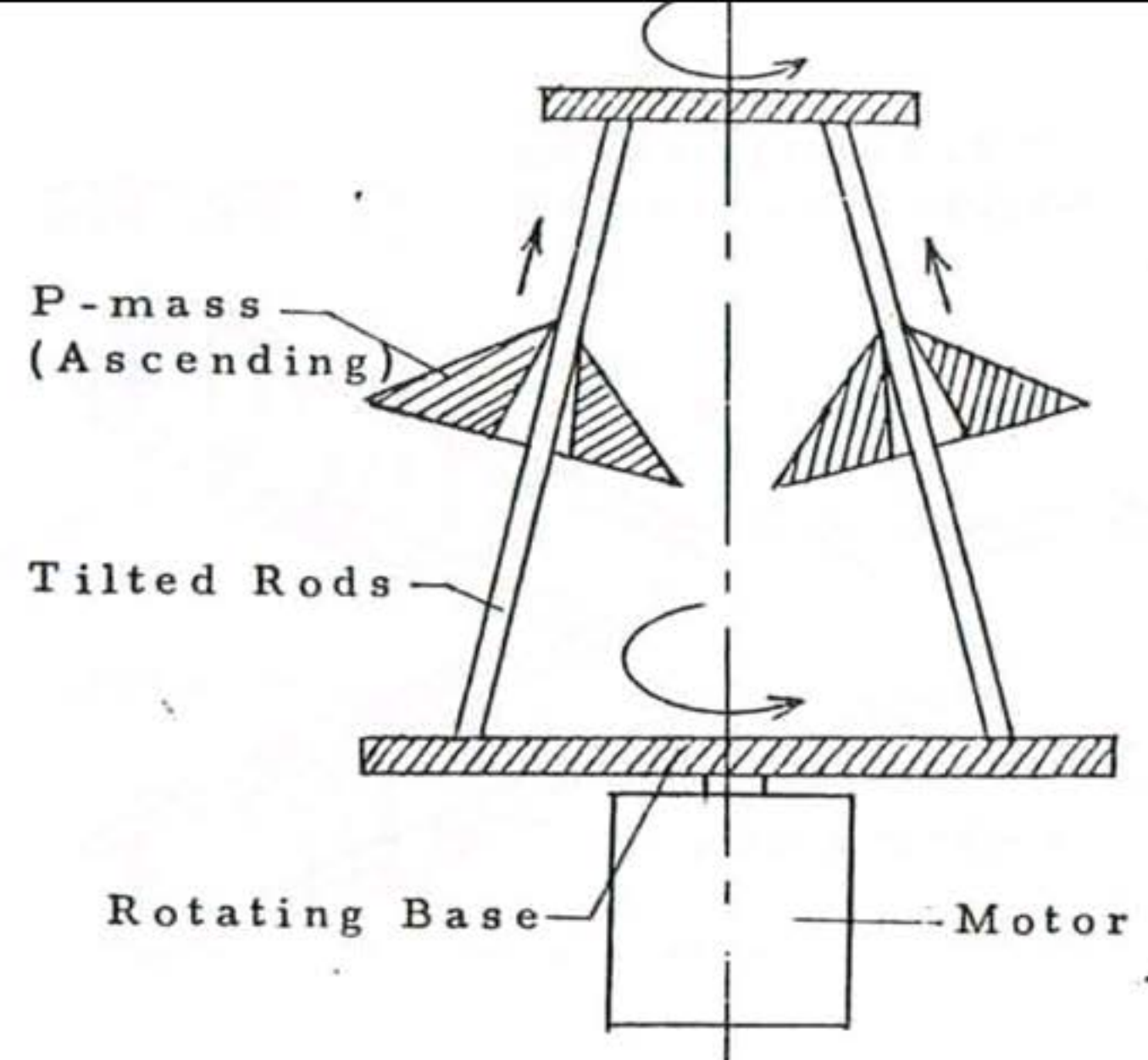


FIGURE 13. - Gamma Drive

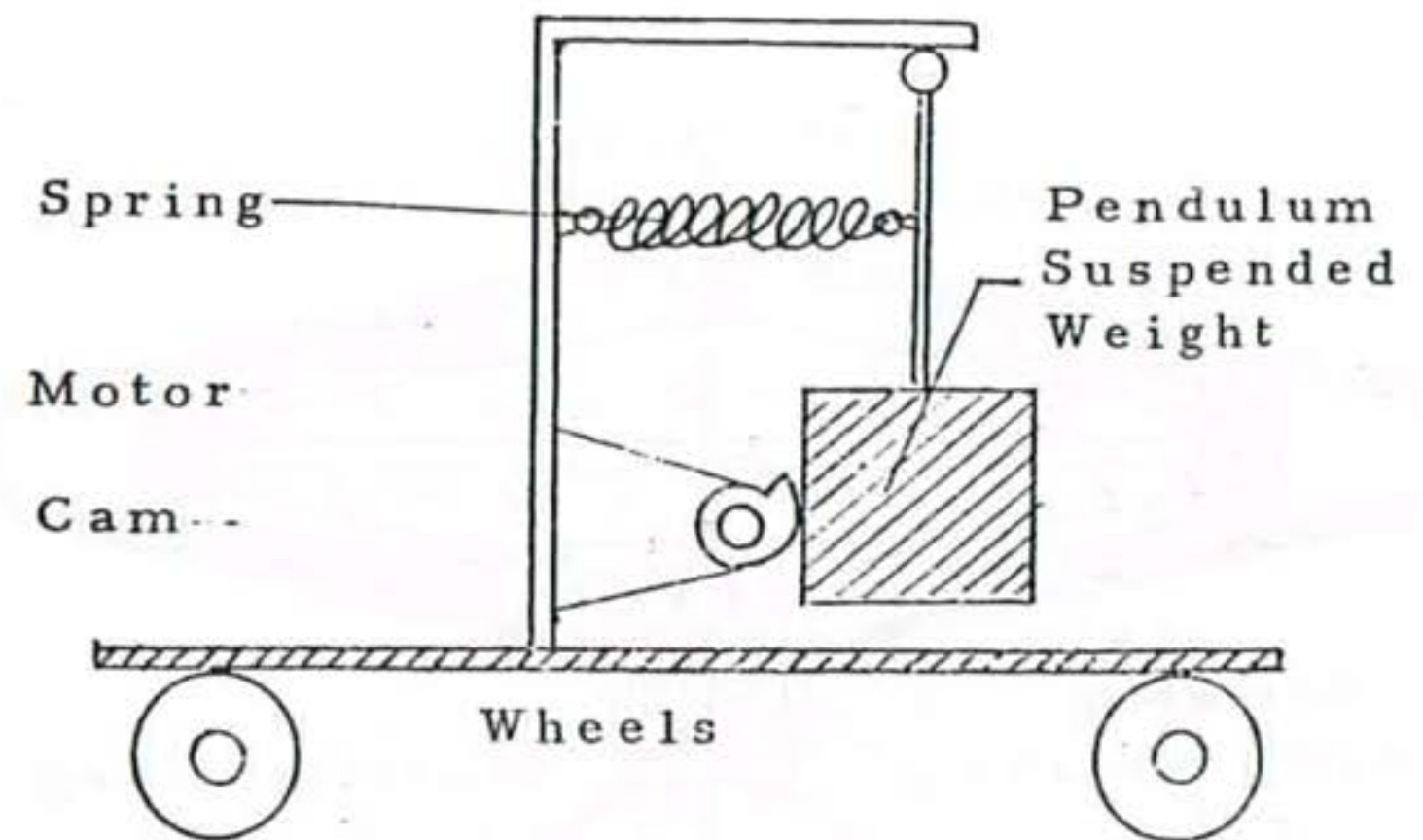


FIGURE 14. - Inertial Propulsion System

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3,187,206

## ELECTROKINETIC APPARATUS

Thomas Townsend Brown, Walkertown, N.C., assignor, by mesne assignments, to Electrokinetics, Inc., a corporation of Pennsylvania

Filed May 9, 1958, Ser. No. 734,342

23 Claims. (Cl. 310-5)

This invention relates to an electrical device for producing thrust by the direct operation of electrical fields.

I have discovered that a shaped electrical field may be employed to propel a device relative to its surroundings in a manner which is both novel and useful. Mechanical forces are created which move the device continuously in one direction while the masses making up the environment move in the opposite direction.

When the device is operated in a dielectric fluid medium, such as air, the forces of reaction appear to be present in that medium as well as on all solid material bodies making up the physical environment.

In a vacuum, the reaction forces appear on the solid environmental bodies, such as the walls of the vacuum chamber. The propelling force however is not reduced to zero when all environmental bodies are removed beyond the apparent effective range of the electrical field.

By attaching a pair of electrodes to opposite ends of a dielectric member and connecting a source of high electrostatic potential to these electrodes, a force is produced in the direction of one electrode provided that electrode is of such configuration to cause the lines-of-force to converge steeply upon the other electrode. The force, therefore, is in a direction from the region of high flux density toward the region of low flux density, generally in the direction through the axis of the electrodes. The thrust produced by such a device is present if the electrostatic field gradient between the two electrodes is non-linear. This non-linearity of gradient may result from a difference in the configuration of the electrodes, from the electrical potential and/or polarity of adjacent bodies, from the shape of the dielectric member, from a gradient in the density, electric conductivity, electric permittivity and magnetic permeability of the dielectric member or a combination of these factors.

A basic device for producing force by means of electrodes attached to a dielectric member is disclosed in my Patent 1,974,483. In one embodiment disclosed in my patent, an electrostatic motor comprises devices having a number of radially directed fins extended from one end of the dielectric body and a point electrode on the opposite end of the dielectric body. When this device is supported in a fluid medium, such as air, and a high electrostatic potential is applied between the two electrodes, a thrust is produced in the direction of the end to which the fins are attached.

Other electrostatic devices for producing thrust are disclosed and described in detail in my British Patent 300,311, issued August 15, 1927.

Recent investigations in electrostatic propulsion have led to the discovery of improved devices for producing thrust by the use of electrical vectorial forces.

Accordingly, it is the primary object of this invention to provide an improved electrical device for producing thrust.

It is another object of this invention to provide a device for producing modulated thrust in response to varying electrical signals, which device produces a greater effect than the prior type devices mentioned above.

It is another object of this invention to provide a device which shapes or concentrates electrostatic flux to produce an improved thrust.

Broadly, the invention relates to shaping an electrical field to produce a force upon the device that shapes the field. The electrical field is shaped by the use of an elec-

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trode of special configuration whereby the electric lines-of-force are made to converge at a distance from the electrode. One illustrative embodiment of this invention which satisfies the above requirement is an arcuate surface or, alternatively, a system of wires, tubes or plates embedded in a dielectric surface and forming a directive array. One such highly-charged electrode acting within and upon an ambient of different electrical potential will move in response to the forces created by the shaping of the electrostatic field. If a smaller electrode is added at or near the focus of the field-shaping electrode and mechanically attached to that electrode, both electrodes as a system will move in a direction of the larger or field-shaping electrode. As is mentioned above, the field-shaping electrode alone, when charged with respect to its electric ambient, will move or possess a force in the direction of its apex. If another electrode carrying a different charge is added at or near the focal point of the field-shaping electrode, then the field becomes more concentrated, i.e., shaped to a greater degree and the resulting thrust is greater than that which exists when the field-shaping electrode alone is employed.

Briefly in accordance with aspects of this invention, an electrode is connected on each end of a dielectric member and one of the electrodes defines a large area flat or preferably arcuate surface which is curved in such a direction to produce, usually in co-operation with the other electrode, a shaped electrostatic field.

Advantageously, if the arcuate electrode is in the form of a parabola or hyperbola, the length of the dielectric member may be such that the other electrode is located in the region of the focus of the parabola or hyperbola, as the case may be. If the arcuate electrode is hemispherical, the other electrode is located near the center of the hemisphere.

In accordance with other aspects of this invention the dielectric member supporting the two electrodes may have electrical conductivity and/or dielectric constant which varies progressively between its ends so that the dielectric member contributes to the non-linearity of the field gradient and causes a greater thrust to be developed.

In accordance with still other aspects of this invention, an annular electrode member is secured to an electrode mounted in the region of the axis of the annular electrode. If the second electrode is located at the center of the annular electrode and the two electrodes are energized, such force is not detected. However, if the second or innermost electrode is displaced from the center of the annular electrode in the region of the axis of the annular electrode and the electrodes are energized, then thrust will be produced by the two electrodes. The annular electrode may either be a flat ring, a toroid, or a section of a cylinder.

In accordance with still other aspects of this invention, tapered dielectric members having electrodes secured to opposite edges thereof may be employed to produce a thrust in response to the application of potentials to these electrodes. The thrust produced by these tapered dielectric members may be further augmented by embedding massive particles, such as lead oxide, in the wedges, which particles are usually more concentrated near the points of the wedges.

Accordingly, it is a feature of this invention to provide an electrical device for producing thrust which includes a dielectric member and electrodes supported at each end of the dielectric member, one of which electrodes is located in the region of the focal point of the arc of the arcuate surface electrode.

It is another feature of this invention to provide a device for producing thrust having a dielectric member and a pair of electrodes secured to opposite ends of the dielectric rod or member, one of which electrodes de-

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finer a parabolic or hyperbolic surface, the other electrode being located in the region of the focus of said surface.

It is another feature of this invention to employ an insulating rod or member between two electrodes, which rod or member has a varying dielectric constant, said dielectric constant progressively increasing or decreasing along the length of the dielectric member.

It is still another feature of this invention to employ a rod or member connected between two electrodes across which an electrostatic potential is applied, which rod or member has a varying electrical conductivity, said conductivity progressively increasing or decreasing along the length of the dielectric member.

It is another feature of this invention to employ a single electrode having an arcuate surface and to connect a source of potential to the arcuate surface which is opposite in polarity to the potential of the masses comprising the environment of the arcuate surface.

It is still a further feature of this invention to employ an arcuate electrode as a device for producing thrust and to apply a varying electrical signal to the arcuate electrode.

It is still another feature of this invention to employ a wedge of dielectric material having electrodes on opposite ends thereof to produce a thrust in response to the application of electrical potentials.

It is still a further feature of this invention to employ a tapered dielectric material having massive particles embedded therein to produce a thrust in response to the application of potentials to the electrodes secured to the dielectric member.

It is still a further feature of this invention to employ an annular ring electrode and a second electrode secured to the annular electrode in the region of the axis of the annular electrode to produce a thrust in response to the application of electrical potentials thereto.

These and various other objects and features of this invention will be apparent from a consideration of the following description when read in connection with the accompanying drawing wherein:

FIGURE 1 is a view in elevation of one illustrative embodiment of this invention;

FIGURE 2 is a view in elevation, partly in section, of another illustrative embodiment of this invention;

FIGURE 3 is a graphical representation of the field gradient between the electrodes of one illustrative example of this invention in which distance from one electrode is plotted as the abscissa whereas flux density is plotted as the ordinate;

FIGURE 4 is a perspective view of another illustrative embodiment of this invention;

FIGURES 5 and 6 are perspective views of still another illustrative embodiment of this invention;

FIGURE 7 is an end view of another illustrative embodiment of this invention employing a pair of devices of the type disclosed in FIGURE 6, which devices are mounted and serially connected in a single array;

FIGURES 8A, 8B and 8C are views in elevation, partly in section, of still other illustrative embodiments of this invention.

Referring now to FIGURE 1, there is depicted an insulating member 10 having an arcuate electrode 12 mounted on one end thereof and a second electrode 14 mounted on the opposite end thereof. A source of direct current voltage 13 is connected to electrodes 12 and 14 through conductors 15 and 17, respectively. I have discovered that if two electrodes are mounted on opposite ends of a dielectric member, and a field emanates from these electrodes which produces a linear gradient through the dielectric member as shown by dotted line 30 of FIGURE 3, then no thrust is produced by the dielectric member. However, if the field is distorted to produce a non-linear gradient such as graphically represented by

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line 32 in FIGURE 3, then a thrust will be produced, which thrust will be related to the degree of non-linearity of the field gradient. One way to produce a gradient which varies non-linearly is to shape one of the electrodes in a form of an arcuate surface such as 12. However, numerous other ways to influence the field gradient will be disclosed below. Electrode 14 represents a substantial mass and it has been found that best results are obtained if the surface area of electrode 14 is greater than the surface area of the end of rod 10. In one particular example, a spherical electrode having a diameter greater than the diameter of rod 10, produced very satisfactory results. Advantageously, the dielectric member 10, may be employed to increase the non-linearity of the field gradient. For example, the dielectric member may be of material having a uniform relative dielectric constant and be tapered in the direction of electrode 14 such that the member 10 in the region of electrode 12 has a much greater cross-sectional area than the end of member 10 which is connected to electrode 14. An equivalent result may be obtained if the member 10 is of uniform diameter but has a dielectric of graduated density or which comprises a material having a progressively different electrical conductivity or dielectric constant. In any of these arrangements, the dielectric constant, or alternatively the electrical conductivity, varies from a low value in the region of electrode 14 to a high value in the region of electrode 12.

The arcuate electrode 12 may be either a stitched wire surface or a solid conducting surface. In the case of stitched wire surface, the wires are very close together so that when an electrical potential is applied to these wires, they act substantially in the same manner as a conductive surface. Arcuate electrode 12 will produce a thrust when a potential is applied to the electrode 12 which is opposite in polarity to the potential of the bodies in the region of electrode 12. Such a thrust will be produced even though the dielectric member 10 and the electrode 14 are eliminated from the structure. However, the thrust produced by the charged arcuate electrode 12 when actuating alone is less than the thrust produced by the combined device, that is, employing the dielectric member 10 and the oppositely charged electrode 14.

Referring now to FIGURE 2, there is depicted another illustrative embodiment of this invention in which field-shaping is accomplished. In the embodiment of FIGURE 2, the planar electrode 18 is connected to a hemispherical electrode 14 by means of a dielectric rod 10. When a source of electrical potential (not shown) is connected through wires 15 and 17 to electrodes 18 and 14, respectively, a field gradient will be produced between electrodes 18 and 14, which field gradient varies in accordance with the graph represented by solid line 32 of FIGURE 3. In this particular embodiment, as well as in the embodiment of FIGURE 1, the non-linearity of the field gradient is further augmented by the use of a connecting rod 10 which is a dielectric with progressively different dielectric constant between electrodes 18 and 14. A similar result may be produced by the use of a rod 10 having electrical conductivity which varies progressively between electrodes 18 and 14.

Referring now to FIGURE 4 there is depicted still another illustrative embodiment of this invention in which a thrust is produced in response to the application of electrical potentials.

A frusto-conical surface 25 comprising a metal or having a metal surface to be used on an electrode is connected to a tapered member 27. The tapered member 27 is frusto-conical and is primarily of non-conductive material but contains granules of semi-conducting material, which granules are concentrated near the tip 28. Mounted on tip 28 is a half-wave radiator 29 which may be in the form of a disk. It is to be noted that the axis